Final Supplemental
Environmental Impact Statement

FHWA-RI-EIS-79-01-FS

Record of Decision

for the

Jamestown Bridge Replacement Project

North Kingstown and Jamestown, Rhode Island

R.I. Federal Aid Project Nos.
BRF-0138(002) & BRF-0238(005)

Rhode Island Department of Transportation
and the
U.S. Department of Transportation
Federal Highway Administration

March 2004

RECORD OF DECISION
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1. Project Overview

This Record of Decision (ROD) explains the decision reached on the implementation of an alternative for the project to remove and dispose of the Old Jamestown Bridge. It is issued under the requirements of 40 CFR 1502.2 and 23 CFR 771.127.

In 1981 the Rhode Island Department of Transportation (RIDOT) issued a Final Environmental Impact Statement (FEIS) for the Jamestown Bridge Replacement Project, which evaluated the replacement of the existing bridge crossing of State Route 138 over the West Passage of Narragansett Bay. Although construction of the new Jamestown-Verrazano Bridge was completed in 1992, the original Jamestown Bridge (Bridge No. 400) has not yet been removed. The removal of the Old Jamestown Bridge remains a condition of the permit granted by the United States Coast Guard to the RIDOT for the construction of the new Jamestown-Verrazano Bridge. Since the completion of the new bridge, the Coast Guard has further ordered that the bridge be removed due to safety concerns. Additionally, both the towns of North Kingstown and Jamestown have formally requested that the RIDOT remove the obsolete structure. Since the removal of the old bridge remains a commitment of the FEIS for the Jamestown Bridge Replacement Project, the RIDOT is legally obligated to remove the Old Jamestown Bridge.

In accordance with the National Environmental Policy Act (NEPA), a Supplemental Environmental Impact Statement (SEIS) has been prepared to address the environmental impacts associated with the removal of the Old Jamestown Bridge. The purpose of the SEIS is to address the environmental considerations of bridge demolition operations and identify and evaluate the available alternatives for the ultimate disposition of bridge materials. Since the bridge must be removed for the reasons described above, a no-build alternative is not applicable to this project. Accordingly, the project alternatives are the same in terms of the bridge demolition but differ in the manner by which the resulting bridge debris (approximately 7,000 tons of steel and 26,500 cubic yards of concrete) is ultimately disposed. The SEIS addresses the potential impacts of demolition operations and identifies mitigation measures and performance standards through which these impacts can be minimized to the greatest extent possible.

Three viable alternatives for the disposal of demolition debris were identified in the development of the Draft SEIS for this project. Each of the alternatives described below has been evaluated in terms of anticipated social, economic, and environmental consequences and their comparative merits:

1. *Landfill Disposal Alternative* - Under this alternative, all structural steel debris would be salvaged and recycled and all concrete debris would be transported for permanent placement in an upland landfill disposal site.

2. *Artificial Reef Alternative* - Under this alternative, all structural steel and concrete debris would be deployed by barge to create marine artificial reefs in Rhode Island's offshore waters.

3. *Hybrid Alternative* - Under this hybrid of the two above alternatives, all structural steel would be salvaged and recycled and marine artificial reefs would be created using concrete debris.

As the most expensive alternative, The Landfill Disposal Alternative is estimated to cost between 20 and 24 million dollars (of which approximately 4.5 million dollars would be incurred in landfill disposal fees alone). The transport of concrete debris via truck from a barge unloading site to a landfill would generate noise, air quality, and traffic impacts for the duration of removal operations. Given that this alternative would also result in the permanent consumption of a significant volume of landfill space and extend no benefits to the community, the Landfill Disposal Alternative has not been considered as a prudent alternative for the bridge removal project.

Although they differ primarily in the ultimate disposition of steel debris, both the Artificial Reef Alternative and the Hybrid Alternative would have similar impacts and offer commensurate benefits. Based on the successes of past artificial reef initiatives in other States, the placement of suitable structure at selected barren ocean bottom areas represents a unique opportunity to enhance marine habitat. The use of various bridge materials to construct artificial reefs would also offer potential long-term recreational and economic benefits through the creation of new fishing and sport diving opportunities. Both of these alternatives would result in minor localized noise and air quality impacts in the transport of materials to proposed artificial reef sites, as well as short-term disturbances to bottom sediments in the deployment of materials at these locations. While the Hybrid Alternative would offer material conservation and economic benefits through the recycling of steel, this alternative may also result in short-term impacts in the processing and transport of steel material to a recycling facility (i.e., potential noise, air quality, and traffic impacts). Under both the Artificial Reef Alternative and the Hybrid Alternative, the short-term impacts described above would be outweighed by the potential long-term benefits of artificial reef creation. At an estimated cost between 16 and 20 million dollars, both of these alternatives would represent a significant economic and environmental benefit when compared with the conventional Landfill Disposal Alternative.

The Draft SEIS for the Jamestown Bridge Replacement Project was approved for distribution on February 7, 2003, in which the Artificial Reef Alternative was identified as the Preferred Alternative. At the time the Artificial Reef Alternative was deemed to be preferable in terms of artificial reef development, since the limitation of material to concrete debris under the Hybrid Alternative would limit the opportunity to create a diverse series of artificial reefs for different purposes and user groups. Preliminary analyses also indicated that any reduction in the overall cost of the project through the salvage of structural steel would likely be offset by the additional costs incurred in the materials separation, handling, and mobilization required for both the transport of this material to a recycling facility and the deployment of concrete debris as artificial reefs via barge. Since the Artificial Reef Alternative would constitute a full and complete reuse of the structure to be removed, this option was initially identified as the most prudent means of final disposition for the Old Jamestown Bridge.

A public hearing was held at the North Kingstown High School on March 27, 2003 to solicit comments regarding the Draft SEIS and the bridge demolition project. This was followed by a public comment period which continued until April 25, 2003, during which agencies, organizations and individuals could submit written comments regarding the Draft SEIS. As a result of the public hearing and subsequent comment period for the Draft SEIS, the RIDOT undertook an extensive reassessment of the proposed project and the Preferred Alternative originally identified in the Draft SEIS.

The Final SEIS for this project was approved for distribution on January 4, 2004. Whereas the Artificial Reef Alternative was initially identified as the Preferred Alternative in Draft SEIS, the Hybrid Alternative was selected as the Preferred Alternative in the Final SEIS. The decision to re-designate the Preferred Alternative was primarily based on comments received during the Draft SEIS comment period. The presence of lead-based paints on structural steel elements proposed to be placed in the marine environment under the Artificial Reef Alternative, was a source of concern in the comments received from reviewing agencies and individuals. Based on information gathered in response to the comments, the general consensus among the reviewing agencies was that the results of current research suggest that the bridge steel would not represent an environmental hazard if deployed as reef material. However, based on the level of concern expressed by the public, it was decided that the omission of painted bridge steel from the proposed reefs would effectively eliminate any potential ramifications from the placement of this material into aquatic ecosystems.

As the Preferred Alternative, the Hybrid Alternative is believed to be the most environmentally prudent of the three alternatives identified in the SEIS. The recycling of 7,000 tons of bridge steel will result in the conservation of material resources and will also minimize the potential for lead to enter human or marine environments through the bridge removal project. Furthermore, the opportunity to enhance marine habitat through the creation of artificial reefs will still be realized through the deployment of concrete bridge debris.

During the public hearing and comment period following the release of the Draft SEIS, substantive concerns were raised by local commercial fishing organizations and individuals regarding the three proposed near-shore artificial reef locations (Gooseberry Island, Black Point, Sheep Point) and the potential for reef development to adversely impact bottom trawl and trap fisheries in these areas. After careful deliberation of the merits of near-shore reef development, these three reef site locations were eliminated from consideration.

Through the public comment period for the Final SEIS, further comments were received from the Rhode Island Commercial Fishermen's Association regarding the proposed Block Island Hole Site. The concern of these comments was that reef deployment at this location would interfere with commercial fishing operations. Conversely, natural resource agencies have expressed a preference for deployments at the greatest feasible number of appropriate sites so that the environmental benefits of artificial reef development may be extended as broadly as possible. The reconciliation of these competing interests is best left to the Federal and State agencies with the responsibility for permitting the artificial reef deployments. Therefore, the RIDOT will proceed with the application currently before the Rhode Island Coastal Resources Management Council (CRMC), which identifies Rhode Island Sound and Block Island Hole as proposed deployment sites. The concerns of the Rhode Island Commercial Fishermen's Association regarding these proposed reef locations should be directed to the CRMC during the permitting process. The RIDOT will abide by any decision issued by the CRMC concerning the siting of reefs for this project.

The Final SEIS was further revised where appropriate to address other pertinent public comments received on the Draft SEIS. These comments include such concerns as the mitigation of impacts during the demolition and removal of the Old Jamestown Bridge, particularly during the use of explosives, as well as the avoidance and minimization of potential construction impacts to local communities (including traffic, noise and air quality). A comprehensive summary of all public comment issues and corresponding responses was provided as part of the Final SEIS document.

In the time since the preparation of the Final SEIS, a comprehensive inspection was conducted on the trestle portion of the bridge (from the West Abutment to Pier 28W) proposed for retention and the future development of a public recreational fishing pier. The inspection revealed that this portion of the bridge is in an extremely deteriorated condition, including critical deficiencies in the concrete deck and trestle bents. Through an evaluation of the inspection data it was concluded that (1) the existing trestle section is structurally unfit for the development of a recreational facility, and (2) rehabilitation of the structure is neither practical nor economically feasible. Accordingly, the scope of the proposed bridge demolition and removal has now been broadened to include the entire bridge structure. RIDOT will obtain any additional permits required by Federal and State agencies to cover the additional demolition, which will be conducted in a second phase. The location of the trestle will be retained for potential future recreational fishing use. This change does not increase the amount of debris to be disposed because of changes in the removal depth of the piers (see below). Consequently, FHWA believes the demolition of the trestle section does not change the type, magnitude or quality of the environmental impacts.

Through further coordination between the RIDOT and the United States Coast Guard since the distribution of the Final SEIS, the original pier depth removal requirements for the demolition of the Old

Jamestown Bridge (as stipulated in the Coast Guard permit for the construction of the new Jamestown-Verrazano Bridge) have also been modified. Pending final permit approval, the Coast Guard will now allow for the removal of bridge pier footings to cut-off elevations at or above the natural bay bottom. While still providing adequate final navigational clearances in the region of the old bridge, the removal of pier footings to elevations at or above bay bottom (as opposed to 5 or 2 feet below) will offer several benefits:

- Removal to elevations at or above bay bottom will reduce the number and magnitude of underwater blast events required for the demolition of individual piers, which will reduce potential blast overpressure impacts to the aquatic community.
- Since pier removal below bay bottom will no longer be required, the magnitude and extent of benthic disturbance will be reduced considerably. This in turn will reduce the amount of suspended sediments and potential turbidity impacts.
- The existing bridge piers themselves currently provide habitat structure for marine life within the West Passage. While the upper portions of these piers will be removed, the retention of pier stubs above bay bottom will continue to offer structural "reef" habitat values to the aquatic community.
- A reduction in the required removal depth for pier footings will invariably reduce the costs of demolition and removal for this component of the project.

Since the greatest bulk of concrete is contained in the pier footings, the new removal limits will also reduce the volume of concrete debris generated through the proposed project to approximately 26,500 cubic yards, which includes the additional concrete debris from the entire trestle span. While the quantity of concrete is less than that originally estimated, this volume will nonetheless be sufficient for achieving the objectives of the artificial reef creation component of this project.

2. Decision

In consultation with the RIDOT, the FHWA has selected the Hybrid Alternative as the alternative for the disposition of bridge debris generated from the demolition of the Old Jamestown Bridge. As the selected alternative (reference Section 3, Alternatives), the Hybrid Alternative combines elements of both the Landfill Disposal Alternative and the Artificial Reef Alternative through the recycling of structural bridge steel and the deployment of concrete debris to create artificial reefs. The steel structure made available from the project will be marketed for reuse by the RIDOT in compliance with Section 123(f) of the Surface Transportation & Uniform Relocation Assistance Act of 1987. Given the size and condition of the structure, as well as its location over Narragansett Bay, it is highly unlikely that a feasible and practical use for this structure exists other than recycling the material or creating artificial reefs. If marketing the structure proves untenable, the bridge will be demolished and demolition debris will be retrieved and separated into concrete and structural steel components. Steel debris will then be transported via barge to an unloading site for subsequent transport and sale to a scrap metal salvage facility (as under the Landfill Disposal Alternative). Concrete debris will be deployed via barge for the creation of artificial reefs at the locations approved by the Federal and State permitting agencies.

3. Alternatives Considered

Each alternative is presented and discussed in further detail in Chapter 2 of the Final SEIS. Following a discussion of the affected environment presented in Chapter 3, Chapter 4 of the Final SEIS provides a comprehensive assessment of the anticipated social, economic, and environmental impacts of the selected Hybrid Alternative versus those of Artificial Reef and Landfill Disposal Alternatives.

As previously noted, all of the alternatives considered for this project involve the requisite demolition of the Old Jamestown Bridge. Through the development of the SEIS, potential adverse environmental

impacts and methods to mitigate such impacts were identified and evaluated (reference Sections 4.1 and 4.2 of the Final SEIS). Following additional studies conducted for the Final SEIS and the consideration of public comments received, specific measures to minimize harm relative to the bridge demolition component of this project are provided in Section 5 of this ROD.

A summary of the major values which were important factors in the selection of the hybrid alternative for debris disposal are presented in Table 1. The Landfill Disposal Alternative was not considered prudent due to its elevated cost, potential impacts to landfill resources, and lack of any social or environmental benefits. While the Hybrid and Artificial Reef Alternatives differ only in the disposition of structural bridge steel, substantive concerns were raised by permitting agencies and individuals regarding the presence of lead-based paints on structural steel elements and the possibility for marine ecology and water quality impacts through the placement of this material in the marine environment. Although there is a lack of definitive studies or data documenting the long-term stability of lead-based paints in the marine environment, empirical evidence gathered suggests that such material would not represent an environmental hazard if deployed as reef material. Nonetheless, the omission of bridge steel from artificial reef deployments would effectively eliminate any potential ramifications from the placement of this material in aquatic ecosystems. In the decision to select the Hybrid Alternative, the omission of a potential (albeit unlikely) source of contamination was determined to outweigh the potential benefits steel debris would offer in terms of reef diversity. It is thus believed that as proposed, the Hybrid Alternative is the most environmentally sound of the alternatives for this project.

The proposed action under the Hybrid Alternative will call for (a) the resource recovery of structural bridge steel and (b) the deployment of concrete bridge debris to create marine artificial reefs at the locations approved by the Federal and State permitting agencies. It is believed that the reuse of concrete materials from the Old Jamestown Bridge to create artificial reefs in Rhode Island waters will offer potential environmental, educational, and economic benefits. Through the implementation of the artificial reef creation component of the selected alternative, the proposed project may serve as a pilot program for future artificial reef development in Rhode Island waters.

Table 1
Removal of the Old Jamestown Bridge
Important Factors in the Comparison of Alternatives

Alternative	Estimated Total Cost	Advantages	Disadvantages
Landfill Disposal	$20-24 million	▪ natural resource recovery through the salvage of approximately 6,000 tons of structural steel	▪ considerable increase in overall project cost due to landfill disposal fees (approximately $4.5 million) ▪ permanent consumption of a significant volume of landfill space in the disposal of approximately 38,000 cubic yards of concrete, thus affecting the future handling capacity of State landfill resources ▪ short-term adverse traffic, noise, and air quality impacts in the transport of concrete and steel bridge materials
Artificial Reef	$16-20 million	▪ potential marine habitat enhancement, human recreational & educational benefits (sport angling, artificial reef ecology) ▪ potential long-term economic (recreation & tourism) benefits to local communities ▪ viable reuse of bridge structure	▪ presence of lead-based paints in structural steel elements; unresolved concerns regarding long-term ecological impacts of lead-based paints in the marine environment
Hybrid	$16-20 million	▪ natural resource recovery through the salvage of approximately 6,000 tons of structural steel ▪ potential marine habitat enhancement, human recreational & educational benefits (sport angling, artificial reef ecology) ▪ potential long-term economic (recreation & tourism) benefits to local communities ▪ viable reuse of portions of the bridge structure	▪ potential short-term adverse traffic, noise, and air quality impacts in the transport of steel bridge materials for salvage

4. Section 4(f)

The Federal Highway Administration has determined that the proposed bridge removal project will constitute the use of a historic property as defined by Section 4(f) of the Department of Transportation Act of 1966, as amended. A Programmatic Section 4(f) Evaluation of the proposed project has been prepared and is summarized in Section 5.0 of the Final SEIS. The full Programmatic Section 4(f) Evaluation is provided in Appendix F of the Final SEIS.

The Programmatic Section 4(f) Evaluation evaluates the potential effects of the proposed project on the Old Jamestown Bridge (Bridge No. 400), a property determined eligible for listing in the National Register of Historic Places through consensus between the Federal Highway Administration (FHWA) and

the Rhode Island Historical Preservation & Heritage Commission/Rhode Island State Historic Preservation Office (RISHPO). In consultation with the RISHPO, the FHWA has determined that the project will have an adverse effect on the Old Jamestown Bridge. Measures to minimize harm to the historic property have been established through coordination efforts undertaken in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended. As part of the Section 106 process, a Memorandum of Agreement (MOA) was developed among the FHWA, RISHPO, and RIDOT and ratified by these parties. This MOA is appended to the Programmatic 4(f) Evaluation provided in Appendix F of the Final SEIS. Measures to minimize harm as stipulated in the MOA include the following:

- the establishment of procedures and coordination to ensure the documentation and recordation of the Old Jamestown Bridge and its demolition;
- the removal and salvage of builders' plaques prior to demolition for permanent archiving and curation;
- the development of a public education interpretive display about the Old Jamestown Bridge;
- the production and distribution of a popular report regarding the Old Jamestown Bridge, in order to make the general public aware of, and provide the general public with access to, information about this important historical resource.

The Programmatic Section 4(f) Evaluation demonstrates that there are no feasible and prudent alternatives to the use of the Old Jamestown Bridge (i.e., the salvage of structural steel and deployment of concrete debris to create marine artificial reefs).

5. Measures to Minimize Harm

Through the development of the Supplemental Environmental Impact Statement for this project, all efforts have been made to identify measures by which impacts to human and marine environments may be minimized to the greatest extent possible. Specific measures to be incorporated into the project design shall include, but are not limited to, the following:

- A detailed demolition plan shall be developed for review and approval by the RIDOT. This plan shall include the construction means and methods (including design computations), measures to protect fish and wildlife, and the sequence and schedule of operations.
- It is anticipated that work windows and/or other timing restrictions for underwater explosive demolition shall be employed to minimize impacts to marine fauna while maintaining the safety of the human workers. Such restrictions shall be established through coordination with the permitting agencies (Coastal Resources Management Council, Department of Environmental Management) and shall be set forth in the individual permits for the project.
- Delay charges shall be employed to limit the propagation of blast pressure shock waves resulting from underwater explosive detonations. Delay charges divide a large charge into a series of smaller charges which are detonated with millisecond delays between each blast. The result is a blast event of equal force to the single, larger charge but with much lower peak pressures and impulse strengths generated.
- Confined charges shall be required for the underwater demolition of bridge piers. The detonation of charges confined in the structure to be demolished has also been shown to be a highly effective means of both mitigating blast impacts to the surrounding environment and improving demolition efficiency, since less energy is dissipated in the surrounding water. A confined charge exploded inside the structure channels more energy into breaking apart the structure and less to propagation of a potentially harmful shock wave, as the structure itself acts as a buffer between the explosion and the surrounding water. Underwater blasting utilizing unconfined charges shall only be allowed under

special circumstances and shall require approval by the RIDOT and natural resource permitting agencies.
- A blast overpressure monitoring program shall be established to measure the effectiveness of the above measures in limiting potential blast impacts on fish and other marine species of concern.
- Boat-based reconnaissance for the presence of marine species of concern (including mammals, reptiles and amphibians) shall be conducted to verify that no such animals are present in the blast area prior to the detonation of an underwater blast event. Pre-blast sonar surveys shall also be conducted to detect the presence of fish and to avoid blasting when large congregations are in the vicinity of blasting operations.
- The area of bay bottom disturbance by falling debris shall be limited to the greatest extent possible. Bridge demolition and removal operations shall be conducted in an efficient and timely manner to minimize the frequency and duration of sediment resuspension events and overall project impacts on the bay ecosystem.
- The Jamestown shoreline shall be protected through the use of erosion control and stabilization devices. All shoreline and upland areas shall be restored to match surrounding natural conditions upon the completion of demolition operations.
- All necessary measures shall be incorporated into the project design to ensure the health and safety of the public, including the maintenance and protection of traffic on the new Jamestown-Verrazano Bridge.
- Seismic monitoring will be conducted during demolition.

With regard to the minimization of impacts during bridge demolition, certain measures were investigated in the SEIS which are not incorporated into this decision. Through a review of the available literature, the use of scare charges, bubble curtains, and acoustical deterrents is not recommended due to their unproven effectiveness under the anticipated conditions of this demolition project. Section 4.2 of the Final SEIS provides a more thorough discussion of all evaluated methods to minimize demolition impacts.

6. Monitoring and Enforcement

Monitoring and enforcement programs during bridge demolition and debris removal will be managed by the Rhode Island Division of the FHWA and by the RIDOT. A detailed list of all commitments made in the FEIS and the ROD will be prepared, including Section 4(f) measures and the above-described measures to minimize harm. Each commitment shall be keyed to the appropriate plan(s) and/or specification(s) to ensure its implementation. The RIDOT will report on the status of each commitment when the preliminary design and Plans, Specifications, and Estimates (PS&E) documents are submitted to the FHWA. A commitment database will be developed for use by the RIDOT and FHWA to track the assignment and status of each commitment

In addition to the above, the RIDOT will monitor and enforce the required project provisions in the following manner:

- RIDOT personnel will review the plans and specifications at every stage of the project development. Those reviews will involve personnel from several disciplines, including the design engineering, environmental engineering, materials construction, and research, development, and technology sections.

- RIDOT staff are presently, and will continue to be, involved in regular communications with the State and Federal regulatory agencies regarding environmental protection and mitigation features of the project.

- RIDOT staff will provide plans and specifications at every stage of development to the municipalities in which the project is located to ensure that local concerns are met.

- As the various sections of the project are advanced to construction, the RIDOT will establish a field office on site staffed by a Resident Engineer and construction inspectors. Site visits will also be made on a regular basis by RIDOT staff to monitor the implementation of contract provisions. All requirements specified by the Rhode Island Department of Environmental Management (RIDEM), the Rhode Island Coastal Resources Management Council (CRMC), and the U.S. Army Corps of Engineers (USACOE) through the environmental permitting process will be implemented through the contract and monitored by RIDOT personnel.

The deployment of materials from the Old Jamestown Bridge will likely initiate the beginning of an artificial reef development and management process for the State of Rhode Island. As the proponent of the first artificial reef initiative in the state, the Rhode Island Department of Transportation will assume responsibility for compliance monitoring of the artificial reef sites for a period of three years after the deployment of the artificial reefs. This will ensure that all reef structures remain in compliance with the stipulations set forth in regulatory agency permits and that the long-term stability of the reefs is documented. This monitoring will be performed on an annual basis and will include diver inspections by a qualified contractor at the reef sites. The primary purpose of these investigations will be to document material stability (lateral movement or subsidence) and structural integrity (whether the reef is remaining intact to its original design and configuration elements). Visual inspections will provide a detailed assessment of reef condition and establish baseline data for any future reef development. If compliance monitoring should detect any compliance issues or problems, the appropriate agencies will be informed immediately.

7. Comments on the Final SEIS

The Final SEIS for this project was approved for distribution on January 4, 2004, with notice appearing in the Federal Register on January 16, 2004. A public review period followed and continued until February 17, 2004, during which agencies, organizations and individuals could submit written comments regarding the Final SEIS. This section presents the substantive comments received with responses provided by the RIDOT. Comments from the Rhode Island Department of Environmental Management (RIDEM) and the United States Environmental Protection Agency (EPA) are presented separately at the end of this section.

Comment: I believe that the statement on page 72 of the Final Supplemental Environmental Impact Statement for the Jamestown Bridge Replacement Project which states: "Each of the two offshore reef locations are not expected to impact marine commercial fisheries." is false as the Block Island site is located well within the boundaries of regularly used commercial fishing grounds. The RI commercial fishing industry cannot allow debris to be dumped in prime fishing grounds. The usage of these fishing grounds has been well documented by the RI Coastal Resources Management Council and the RI Commercial Fishermen's Association.

Source: Rhode Island Commercial Fishermen's Association

Response: Thank you for your comments regarding the proposed deployment of concrete bridge debris for the creation of marine artificial reefs in offshore waters. While the RIDOT acknowledges concerns that reef deployment at the Block Island Hole Site would potentially interfere with commercial fishing operations, natural resource agencies have expressed a preference for deployments at the greatest feasible number of appropriate sites so that the environmental benefits of artificial reef development may be extended as broadly as possible. It is believed that the reconciliation of these competing interests is best left to the Federal and State

agencies with the responsibility for permitting the artificial reef deployments. Consequently, the RIDOT will proceed with the application currently before the Rhode Island Coastal Resources Management Council (CRMC) which identifies Rhode Island Sound and Block Island Hole as proposed deployment sites. The concerns of the Rhode Island Commercial Fishermen's Association regarding these proposed reef locations should be directed to the CRMC through public notice period for this application. The RIDOT will abide by any decision issued by the CRMC concerning the siting of reefs for this project.

Comment: This is to notify you that the review of your Final Supplemental Environmental Impact Statement for Jamestown Bridge Replacement is complete. The State Single Point of Contact recommends the project be accepted for federal financial assistance and notes the comments of the Rhode Island Historical Preservation and Heritage Commission.

Source: Rhode Island Statewide Planning Program

Response: The comments of the Rhode Island Statewide Planning Program have been noted.

Comment: The Rhode Island Historical Preservation and Heritage Commission staff has reviewed the Final Environmental Impact Statement for the removal and disposal of the old Jamestown Bridge. We note that in the FEIS the proposed action calls for reusing only the concrete debris for artificial reefs; the structural steel will be salvaged. This change does not affect our finding of adverse effect for the project or require any modification of our existing Memorandum of Agreement. These comments are provided in accordance with Section 106 of the National Historic Preservation Act.

Source: Rhode Island Historical Preservation and Heritage Commission

Response: The comments of the Rhode Island Historical Preservation and Heritage Commission have been noted.

Comment: The Town of North Kingstown has recently reviewed the Supplemental Environmental Impact Statement (SEIS) for the Jamestown Bridge Replacement Project. In completing our review, the Town finds that our previous comments submitted to the RI Department of Transportation during the Draft SEIS process have largely been addressed. The Town recognizes that some of our comments, such as those related to noise and air impacts as well as the impacts on the marine environment, cannot be addressed until a demolition contractor has been selected. We look forward to continue working the RIDOT on addressing these issues.

Source: Richard Kerbel, Town Manager

Response: The comments on behalf of the Town of North Kingstown have been noted.

Responses to Comments from the
Rhode Island Department of Environmental Management
Dated February 16, 2004

Comment 1: Section 3.1.2.2 Composition of Flora and Fauna (p. 24) - Seagrass - this section does not mention the presence of eelgrass along the western shore of Conanicut Island, both north and south of the old bridge. The spatial extent of this resource should be identified and mapped prior to project initiation to allow it to be safeguarded. It is important that this area be avoided during the demolition process, especially when demolishing the eastern abutments on or near the beach.

Response 1: *As noted in the Final SEIS, a work corridor will be established for the bridge demolition which will limit the spatial extent of bay bottom disturbance beneath the bridge to a band approximately 200 feet in width. Demolition operations at the Jamestown shoreline (Piers 8E and 9E) will be further contained with heavy duty sedimentation fencing. While subaqueous demolition and removal operations will invariably result in intermittent turbidity events, these events will not be of a sufficient magnitude, duration, or extent to affect the functions and values of eelgrass resources in the West Passage. It is thus believed that any potential impacts to eelgrass as a result of this project will be minimal and localized, and that mapping the extent of this resource along the shoreline of Conanicut Island would offer no advantage in further minimizing impacts.*

Comment 2: Table 4 & Table 6 (page 25) - These tables, *Ten Most Abundant Fish in Narragansett Bay* and *Pelagic Species Known to be Important in Narragansett Bay* are based upon data collected by Tim Lynch, of RIDEM's Division of Fish and Wildlife. We question the abundance rankings since Lynch, using the same methodology, arrived at different rankings. These statistics appear on the enclosed sheet of two tables.

Response 2: *The discrepancy in fish abundance rankings appears to be due to the fact that the information presented in Table 4 is based on a twelve year data set from 1990 to 2001 (inclusive), whereas the enclosed data is based on trawl survey data from 1979 to 2000. The enclosed abundance rankings have been noted and will be employed in the further development of impact minimization strategies.*

Comment 3: Section 4.1.1 - Explosives, Fish (p. 33) - A work window for the blasting operations is a likely requirement of any Rhode Island Department of Environmental Management (RIDEM) Water Quality Certification for this project. The proposed work period (May through Sept.) is the period of highest biological activity in the Bay. To decrease mortality on particular species, the proposed demolition of each bridge pier might be sequenced such that piers in a particular depth strata are removed during times of the year when fish abundance in that strata are expected to be low.

Response 3: *The details of work windows and/or other blast timing/frequency restrictions will be established through permitting coordination with the RIDEM and the Rhode Island Coastal Resources Management Council (CRMC). The RIDOT is committed to minimizing impacts to the marine environment and ensuring that demolition operations are conducted in a safe and efficient manner.*

Comment 4: Since the RIDEM Fish & Wildlife trawl survey samples demersal species predominately, the mortality estimates derived from the model and used in 6A-C under-estimate the

mortality of pelagic species and fail to address important species like stripped bass and bluefish.

Response 4: *The RIDEM Fish & Wildlife trawl survey data was utilized for the updated mortality model developed for the Final SEIS per RIDEM comments on the Draft SEIS dated May 15, 2003. Although this data may under-represent pelagic species at these survey locations within the Bay, several conservative assumptions have been made for the multiple parameters required for the lethal impulse model, including the assumption of the maximum charge size for all blast events regardless of pier size or depth (p. 37) and the doubling of calculated lethal ranges (p. 38, Note c). It is therefore believed that this model remains a valid approximation of the potential fish mortality which may result from subaqueous explosive demolition operations.*

Comment 5: Page 42 - Fish Larvae - In the Hill model used to predict the estimated larval mortality from the 3 lb confined blast, only cunner, tautog and goby abundance was used (Table 8), with the assumption that these are the only species with swim bladders. The larval species with the highest abundance in Table 8, bay anchovy, was not included in the model as the author incorrectly assumed this species does not have a swim bladder. If true estimates of larval mortality are to be presented, anchovy abundance should be included in the modeling exercise.

Response 5: *The comment is correct in that Bay Anchovy (Anchoa mitchilli) larvae do possess swim bladders and were mistakenly left out of the larval fish mortality estimates. See Section 8 "Final SEIS Errata," of the ROD for a complete discussion.*

Comment 6: Section 4.1.3 Resuspended Sediments (p. 48) - This section does not adequately address the impacts of suspended sediments on early life history of fishes. This issue and its impacts to marine fishes is addressed in several recent papers: Newcombe, C.P. & J.O. Jensen. 1996. Channel suspended sediments and fisheries: a synthesis for quantitative assessment of risk and impact. N. Am. Jour. Fish. Mgt. 16(4) 693-727. and Wilber, D.H. & D.G. Clarke. 2001. Biological effects of suspended sediments: a review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. N. Am. Jour. Fish. Mgt. 21 855-875. A more comprehensive analysis of the potential impact of suspended sediments on all life history stages of fish should be conducted.

Response 6: *Since the original writing of the Draft SEIS for the Jamestown Bridge Replacement Project, there has been some advance into research on the effects of resuspended sediments on marine organisms and specifically fish (including eggs, larvae, juveniles and adults). Much of this research has been derived from studies on dredging impacts. Potential resuspension events likely to occur during bridge demolition operations may be similar to dredging operations and therefore results from this research may provide insight into potential impacts associated with demolition operations. See Section 8 "Final SEIS Errata," of the ROD for a complete discussion.*

Comment 7: Work Windows (p. 54) - this issue needs further discussion with natural resource agencies and it is an issue that will be addressed in any Water Quality Certification issued for the project. RIDEM believes the greatest impact to important fisheries resources in Narragansett Bay will occur if blasting takes place during the warmer months (May - Sept.), and that the concern regarding the potential impact to marine mammals can be better mitigated. All species of sea turtles are either threatened or endangered with several species occasionally reported in Narragansett Bay during the summer months.

Concern for potential impacts to sea turtles should be more prominent than those for marine mammals. Seals, although covered under the Marine Mammal Protection Act are not threatened or endangered, and the occurrence of whales and dolphins in the bay is rare. Also, the pre-blast monitoring for marine mammals and/or sea turtles is much more effective than pre-blast monitoring of fish or invertebrates. We have minimal concern about impacts to winter flounder during blasting in the area of the bridge. Tagging studies have shown that the majority of winter flounder moving in and out of Narragansett Bay use the East Passage. With the exception possible minor spawning in the shoal areas around the western end of the bridge this part of the bay is not an important spawning area for winter flounder. Concerns about the impact of winter blasting on winter flounder are not significant. The potential impact on lobsters from blasting is not as critical during winter months as it is during the warmer months when lobster larvae are in the plankton.

Response 7: *The details of work windows and/or other blast timing/frequency restrictions will be established through permitting coordination with the RIDEM and the Rhode Island Coastal Resources Management Council (CRMC). The RIDOT is committed to minimizing impacts to the marine environment and ensuring that demolition operations are conducted in a safe and efficient manner. The RIDEM's position regarding the minimal potential for impacts to winter flounder and lobster during the winter months has been noted.*

Comment 8: Sediment and Falling Debris (p. 58) - The use of silt curtains is dismissed in the FSEIS due to current speed and curtains' perceived ineffectiveness. Page 22 of the document provides a graph of the tidal speed at the bridge site over a tidal cycle; the highest speed is 0.5 knots. This is well within the recommended 1 knot maximum for the use of silt curtains. Also, the document states that the silt curtain needs to extend to the bottom; this is not what is recommended in the literature. In order to work effectively they need to extend to within 6" to 1' of the bottom. Silt curtain use should be seriously considered if blasting is to take place during periods of high bay productivity.

Response 8: *Based on a thorough investigation of the potential use of silt curtains as a means of controlling sedimentation during bridge demolition, the RIDOT has concluded that their implementation for this project is neither feasible nor prudent. Bay bottom depths at the piers to be removed range from approximately 20 feet at the trestle section to upwards of 60 feet at the center channel. Although maximum tidal speeds are in the range of 0.5 knots, the force of these currents would become significant when exerted over the vertical area of the curtain in the channel section. The set-up, mooring, and maintenance of any siltation fabric barrier device around an individual pier to be demolished would be impractical, time intensive, and problematic; such a device would severely restrict the mobility and operation of demolition equipment, and falling demolition debris would likely tear and/or become entangled in the curtain, thereby compromising its efficacy in controlling sediments.*

Comment 9: Section 4.3.16.1 Artificial Reef Monitoring Plan (p.76) - In addition to the compliance monitoring required of RIDOT for three years following the installation of the offshore reefs, biological monitoring should be required to measure the success of the structures at attracting and enhancing marine resources. It is important to evaluate the effectiveness of the reefs in providing habitat and enhancing fisheries production.

Response 9: The RIDOT is currently investigating the feasibility of a biological monitoring component for the proposed artificial reef project. The details of an environmental monitoring program will be established through further coordination with the RIDEM and CRMC.

Responses to Comments from the
United States Environmental Protection Agency
Dated February 17, 2004

Comment: [Diesel Retrofits and Air Emissions] We are encouraged that the RIDOT is "currently considering the use of diesel retrofit equipment on most land-based equipment within the work site in order to reduce fossil fuel emissions." In order to accomplish this, we recommend that FHWA/RIDOT commit in the ROD to use contract language similar to that of the Connecticut Department of Transportation (ConnDOT) for its Clean Air Construction Initiative on the I-95 New Haven Harbor Crossing Corridor Improvement Program in New Haven. As part of that effort ConnDOT is requiring all contractors and sub-contractors to take part in the Clean Air Construction Initiative. Specific provisions require all diesel-powered construction equipment, with engine horsepower (HP) ratings of 60 HP and above, on the project or assigned to the contract in excess of 30 days to have emission control devices (such as oxidation catalysts) and/or to use clean fuels (such as PuriNOx). In addition, vehicle idling is generally limited to three minutes for delivery and dump trucks and other diesel-powered equipment. EPA strongly encourages Rhode Island to adopt a similar approach for the Jamestown Bridge project.

Lastly, EPA would also suggest that all on-site marine engines and off-road diesel equipment be required to use low-sulfur diesel fuel instead of the high-sulfur type typically used in such equipment.

Response: The RIDOT is currently investigating means by which construction equipment emissions may be minimized in the project, including the feasibility of implementing ConnDOT Clean Air Construction Initiative measures in the contract. The RIDOT will review the ConnDOT Clean Air specifications, and consider using these measures as a guide to reduce emissions impacts for this project.

Comment: [Bridge Demolition/Fishery Impacts] EPA supports the proposed changes to the original project plan to help reduce impacts to existing aquatic habitats (e.g. recycling of steel members and elimination of planned concrete placement in shallow water areas) and believe such modifications should be implemented. We also support the establishment of measures to both monitor and modify any artificial reefs that are developed so that it is clear what steps will be taken if a reef does not function as intended. While we believe the changes to the artificial reef component of the project will help alleviate many of the concerns expressed in comments on the DSEIS, we remain concerned about other impacts associated with demolition activities. Specifically, the FSEIS proposes the May through September time period for in-water demolition activities. EPA believes that demolition during this period will cause unnecessary and avoidable mortality or injury to a significant number of finfish, and that such activities during this period has not been sufficiently justified.

The proposed time period for explosive demolition work coincides with the peak abundance for most resident and non-resident finfish species in the bay. Late spring and summer is also when the densest concentrations of fish larvae exist in the water column, and the young-of-

year of many species are seeking refuge in and around complex habitats such as eelgrass beds, rocky substrate, and hard structures. The FSEIS suggests that these early life stages are when fish are most vulnerable to the effects of submarine detonations.

All species that have swim bladders are at risk to trauma from submarine detonations; however, cunner and tautog will be at particular risk for the following reasons:

- Both species both have swim bladders that can rupture during the rapid compression and expansion associated with the pressure wave of a submarine detonation;

- Both species seek forage and refuge in rocky areas around structures such as bridge abutments, and both tend to stay local, having a limited home range;

- Cunner rarely move far from the safety of structure, and as such, the trawl data used to characterize abundance may have significantly underestimated the number of fish that reside in close proximity to the bridge abutments;

- Both species begin spawning in the spring with post-larval juveniles seeking structured habitat by mid-summer, making them particularly vulnerable to the effects of summer blasting;

- Both species are suffering from sever declines in their stocks in Narragansett Bay. According to the FSEIS (pg.114), both cunner and tautog have shown precipitous declines over the past two decades, with cunner down 98%.

The bridge has likely provided important habitat for structure-oriented species and its demolition will be an added stressor to the remnant stocks. The FSEIS focuses on the most abundant and most "important" species that may be impacted, but attention also needs to be paid to those species most vulnerable to the adverse effects of this project, especially if their local stocks are low.

As a rationale for conducting demolition activities in the summer, the FSEIS states that winter flounder and lobster, two commercially important species, are present in the winter. However, the discussion in this section of the FSEIS fails to note (though the FSEIS does elsewhere) that these species do not have air bladders and impacts to them are not likely to occur. Moreover, finfish without air bladders are not included in the model designed to predict fish mortality. While some concern about winter flounder and lobster may be warranted, these species are probably more vulnerable to the effects of blasting as larvae and post-settlement juveniles during the spring and summer months than they are as mature spawners in winter, according to the general fish size/pressure-trauma information provided in the FSEIS.

The FSEIS identifies a possible compromise on the proposed work windows (pg.55). This compromise would limit the larger submarine blasts to the winter months (or other defined periods) while allowing the smaller blasts to occur in the summer. While the feasibility of limiting blasting to the late fall/early winter period should be more fully explored, even if it requires operations to be conducted in phases (November - December and February - early March), the compromise plan is preferable to the proposed work window of May through September as it would reduce mortality and injury to the fish and other aquatic organisms.

Our comments on the DSEIS requested consideration of non-lethal impairment in the "worst-case scenario" for fishery impacts. In response, the FSEIS reports that no known model utilizes non-lethal impairment data. While this effect may be difficult to quantify or monitor, it nevertheless represents an impact that may be significant. A recent study conducted by NOAA researchers on trauma to juvenile pinfish and spot inflicted by submarine detonations (Govoni, et al., 2003) revealed a variety of injuries to internal organs adjacent to the swim bladder (including the liver and pancreas) in surviving fish. Though the species may be different, this research demonstrates that mortality rates used in the model for this EIS are not likely to adequately represent the extent to which fish are adversely affected.

EPA supports efforts to monitor fish mortality during the demolition period in a manner that will allow for changes to the demolition protocols to further avoid/minimize impacts.

Response: *The details of work windows and/or other blast timing/frequency restrictions will be established through permitting coordination with the Rhode Island Department of Environmental Management (RIDEM) and the Rhode Island Coastal Resources Management Council (CRMC). The RIDOT is committed to minimizing impacts to the marine environment and ensuring that demolition operations are conducted in a safe and efficient manner. The potential for impacts to cunner and tautog has been noted and will be addressed in the final design of mitigation measures for this project. EPA support for a work window compromise in which larger subaqueous blast events are scheduled around times of high ecological activity has also been noted and will be considered through coordination with the RIDEM and CRMC.*

While it is acknowledged that the lethal impulse model employed in the Final SEIS does not consider non-lethal impairment of fisheries, it should be noted that several conservative assumptions have been made for the multiple parameters required for the model; these include the assumption of the maximum charge size for all blast events regardless of pier size or depth (p. 37) and the doubling of calculated lethal ranges (p 38, Note c). It is therefore believed that this model remains a valid approximation of the potential impacts to fisheries which may result from subaqueous explosive demolition operations. Any mitigation measures employed to reduce fish mortality should also reduce non-lethal impairment impacts as well.

8. Final SEIS Errata

Based on comments received from the Rhode Island Department of Environmental Management, the following two items are provided to correct errata contained in the Final SEIS:

1. Page 42 - Fish Larvae

Bay Anchovy (*Anchoa mitchilli*) larvae possess swim bladders and were mistakenly left out of the larval fish mortality estimates.

Estimates on larval fish mortality were recalculated using the Hill Model as described in the Final SEIS and employing abundance data for Bay Anchovy in addition to the other three species used in the original calculations (cunner, tautog, and goby). Upon recalculation of the Hill Model, it was found that the original mortality estimates, in addition to omitting bay anchovy, also contained a calculation error. As a result of both the omission of bay anchovy, and the calculation error, the larval fish mortality estimates presented in the Final SEIS of 3,200 larvae per 3 lb confined blast significantly underestimate the likely blast impact. Upon inclusion of bay anchovy, and recalculation, a corrected estimate of larval fish mortality would be approximately 300,000 larvae per 3 lb confined blast (approximately one hundred times greater than the value originally stated in the Final SEIS).

Although the recalculated larval fish mortality estimates indicate significant numbers of larvae may be impacted by blast events, it should be emphasized that this is primarily due to the exceedingly high concentration of larvae. Larvae are approximately one thousand times more concentrated than adult fish in the Bay. Thus, even under normal circumstances, larval fish mortality is exceedingly high: assuming the very rough ratio of 1000 larvae per adult, this implies a mortality rate of 99.9% in larval fish. To put the larval fish mortality estimates into perspective, applying this very rough "normal larval mortality" rate of 99.9%, the estimated mortality of 300,000 larvae would correspond to approximately 300 adult fish per blast.

2. Section 4.1.3 - Resuspended Sediments (p. 48)

Since the original writing of the Draft SEIS for the Jamestown Bridge Replacement Project, there has been some advance into research on the effects of resuspended sediments on marine organisms and specifically fish (including eggs, larvae, juveniles and adults). Much of this research has been derived from studies on dredging impacts. Potential resuspension events likely to occur during bridge demolition operations may be similar to dredging operations and therefore results from this research may provide insight into potential impacts associated with demolition operations.

In a review on the potential impacts of dredging operations due to sediment resuspension, Clarke and Wilber (2000) conclude the following:

> More than 20 years ago, the existing literature did not permit a "neat compilation and analysis" of the ecological consequences of dredging (Morton 1977). Despite continued concern and research in this area, particularly with respect to effects of suspended sediments, assessments of potential impacts on aquatic organisms remain highly subjective. Clearly, many past investigations focused upon detrimental effects induced by dosages well above those likely to occur at dredging project sites. Also obvious is the fact that appropriately designed studies to address dredging impacts are very limited in number and breadth of coverage, both with respect to taxa and life history stage. The lack of relevant data continues to foster controversy in impact assessments. Extrapolations from responses at inappropriate concentrations or exposure durations are widespread and engender interpretations rife with opportunities for false conclusions. Likewise,

> generic assessments of impacts based on responses across broad taxonomic lines should be viewed with extreme caution. Until adequate data are available quantifying biological responses to appropriate concentration/ exposure duration dosages, assessment of potential dredging-induced impacts must unfortunately remain subjective. The authors endorse the construction of models (e.g., Newcombe and Jensen 1996) to integrate "best available knowledge" and to optimize objectivity in the assessment process.

The discussion below should also be viewed with caution and is meant to provide at least some insight and point of discussion for potential impacts on fish due to sediment resuspension.

As discussed in the Final SEIS, adult and juvenile fish are not expected to be severely disrupted directly by sediment resuspension events as these motile organisms are capable of vacating disturbed areas. However, extended disturbance events could indirectly impact adult and juvenile fish by reducing potential foraging and breeding areas. As resuspension events are expected to be short-lived during demolition activities, adult and juvenile fish are not anticipated to be appreciably affected.

Fish eggs and larvae incapable of vacating disturbed areas are potentially much more susceptible to harmful impacts from resuspension events. Recent literature does suggest that some estuarine species may be particularly sensitive to suspended sediments. Clarke and Wilber (2000) summarize that "the eggs and larvae of estuarine and coastal fish exhibit some of the most sensitive responses to suspended-sediment exposures of all the taxa and life history stages for which data are available." This susceptibility appears to be highly species-specific. For example, bioassay experiments have observed lethal effects at suspended sediment dosages as low as several hundred mg/L over a 24 hour exposure in certain species of larvae, while no effects were observed in some species at concentrations over 10,000 mg/L for 7 days. Atlantic silversides (*Menidia menidia*) and white perch (*Morone americana*) are among the fish with the most sensitive lethal responses, exhibiting 10% mortality at concentrations less than 1000 mg/L for 1 and 2 day durations, respectively (Clarke and Wilber 2000).

Using a wide variety of published data, Newcombe and Jensen (1996) developed mathematical models to attempt to quantify potential suspended sediment impacts on a variety of freshwater and estuarine fish species. The empirical equations developed employed a "severity scale of ill effects associated with excess suspended sediments" which divided impacts into a 14 point scale, with 0 being no impact and 14 representing 80-100% mortality. These empirical equations relate biological response to both suspended sediment concentration, as well as exposure duration.

Applying the equations developed by Newcombe and Jensen (1996) for eggs and larvae of salmonid and non-salmonid species, the suspended sediment concentration at which a given severity of impact might be expected after a 39 hour exposure can be estimated. An exposure time of 39 hours was chosen as this was the calculated time it would take for redeposition to occur following a resuspension event in the area of bridge demolition activities (Final SEIS).

The model results indicate that Newcombe and Jensen's equation for eggs and larvae is not very robust for low severity impacts: severity impacts as high as 7 on their scale are predicted to occur at suspended sediment concentrations of virtually 0 mg/L (reference Table A below). Even indications of major physiological stress are predicted to occur at concentrations of 2 mg/L, a value below the typical ambient suspended sediment concentrations in the vicinity of the bridge. The model results are useful for indicating however that concentrations need to increase significant amounts for lethal impacts to occur. The model results predict that concentrations of greater 1000 mg SS/L would need to occur for 39 hours to cause direct mortality in 0-20% of eggs and larvae. Concentrations would need to increase nearly 25-fold before the next severity level is reached. These results suggest that while estuarine fish larvae are

potentially highly sensitive to suspended sediment impacts, events of relatively short duration (i.e. 39 hours) would have to be quite significant to result in large scale mortality of larval fish.

Newcombe and Jensen (1996) also hypothesize that exposure duration may be more significant in determining impact than suspended sediment concentration. While it is difficult to predict how much resuspension may occur during demolition activities, the duration of resuspension is likely to be a more well-constrained and predictable variable due to the adherence to Stokes Law. Therefore, although estuarine fish eggs and larvae may be susceptible to sediment resuspension impacts, the relatively short duration of the predicted resuspension events (39 hours) would still suggest that no long-term damage will be sustained to local fish populations during demolition activities.

Table A: Suspended sediment concentration predicted to result in described effect after a 39 hour exposure period applying empirical equation developed by Newcombe and Jensen (1996) for eggs and larvae of salmonids and non-salmonids.

Severity	Description of Effect	Predicted Suspended Sediment Concentration (mg SS/L)
0	No effects	
1	Alarm reactions	0
2	Abandonment of cover	0
3	Avoidance response	0
4	Short-term reduction in feeding rates	0
5	Minor physiological stress	0
6	Moderate physiological stress	0
7	Moderate habitat degradation	0
8	Indications of major physiological stress	2
9	Reduced growth rate; delayed hatching	54
10	0-20% mortality	1336
11	>20-40% mortality	33,000
12	>40-60% mortality	817,000
13	>60-80% mortality	20,215,000
14	>80-100% mortality	500,019,000

Literature Cited:

Clarke, D. G., and Wilber, D. H. (2000). "Assessment of potential impacts of dredging operations due to sediment resuspension," DOER Technical Notes Collection (ERDC TN-DOER-E9), U.S. Army Engineer Research and Development Center, Vicksburg, MS. www.wes.army.mil/el/dots/doer.

Newcombe, C.P. and J.O.T. Jensen. 1996. Channel suspended sediments and fisheries: A synthesis for quantitative assessment of risk and impact. N. Amer. J. Fish. Manag., 16(4): 693-727.

9. Conclusion

Based on the analysis and evaluation provided in the Final Supplemental Environmental Impact Statement (SEIS) and after careful consideration of all the social, economic, and environmental factors and input through the public involvement process, the U.S. Department of Transportation, Federal Highway Administration (FHWA) hereby adopts the Hybrid Alternative described in the Record of Decision as the selected alternative for this project.

March 19, 2004
Date of Approval

Lucy Garliauskas, Division Administrator
Federal Highway Administration

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